

# **Development of Cost-effective Diagnostics and Therapeutics Strategies Employing Emerging Technologies to Combat Mental Illness Epidemic in USA**

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## **Abstract:**

This article attempts to understand the causes of growing cases of acute depression across the globe and highlight the major causes of psychological disorders specifically in USA. The Learning Helplessness (LH) model is critiqued as one of the possible causes for the increase of the disease. Moreover, the growing number of mental diseases is linked with the flaws in the existing models, diagnostics, therapeutics and remedies have been suggested through the use of emerging technologies. The reduction in the budgets for the mentally sick and the growing number of the smart phones, apps and other technologies used by American public are discussed. A cost effective model based upon the emerging technologies to diagnose and treat the mental illness is proposed.

**Keywords:** Learning Helplessness Model, Stress Algorithm, Mobile Application

## **Introduction**

God created universe with a purpose [1]. Despite this human beings are not performing to their maximum potential [2]. In USA, the estimated mental health spending in the retail prescription drug category has increased by approximately 15 % from 2003 till 2007 as shown in Fig 1.

The Fig 3 reports the mentally ill from 1987 till 2007. If we compare the data shown in fig 1 with fig 2 it can be easily seen that the increase in the spending on the medicines has no major impact on the decrease in the mental diseases. This trend can also be seen if we compare the data on the number of patients suffering from mental disorders in 1955 with the relevant data shown in Fig 3. Unexpectedly, the number of the mentally sick has increased dramatically and has taken the form of an epidemic proportion. [14]

According to one survey, one in every 17 persons living in USA suffers from severe mental illness such as schizophrenia, major depression, or bipolar disorder. Similarly, one in 10 children suffers from a serious mental ailment. Recently the worst recession after the Great Depression has severely affected an already weak public mental health infrastructure in America.

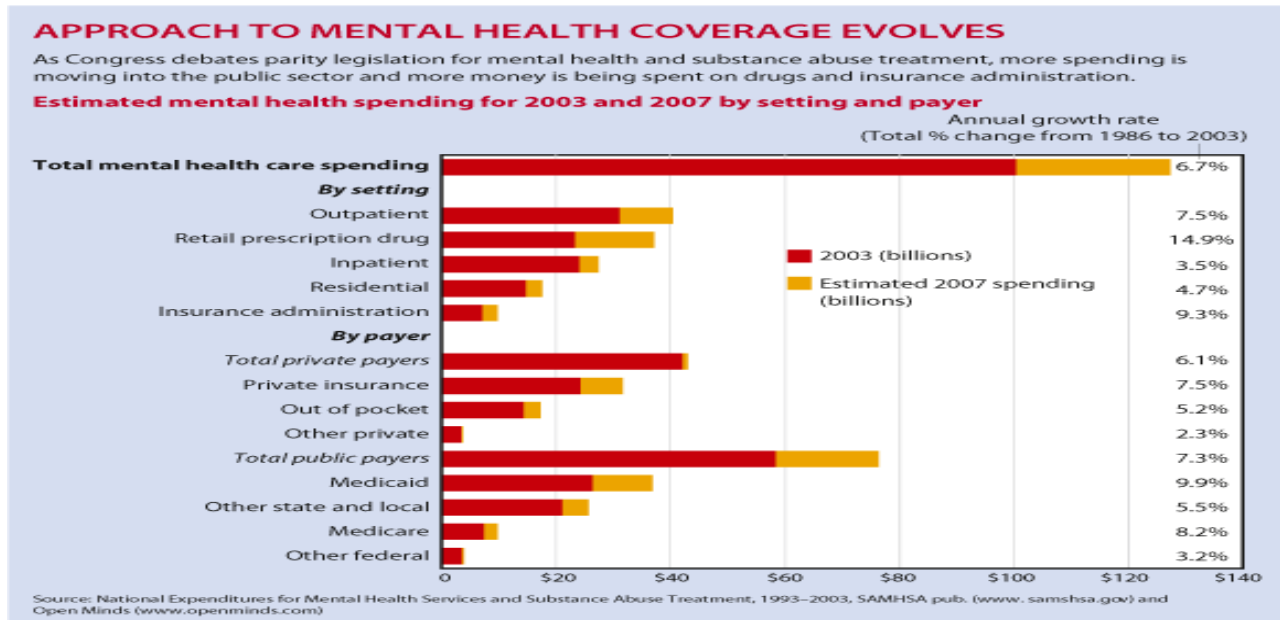


Fig 1, Estimated mental health spending for 2003 and 2007 in USA [13]

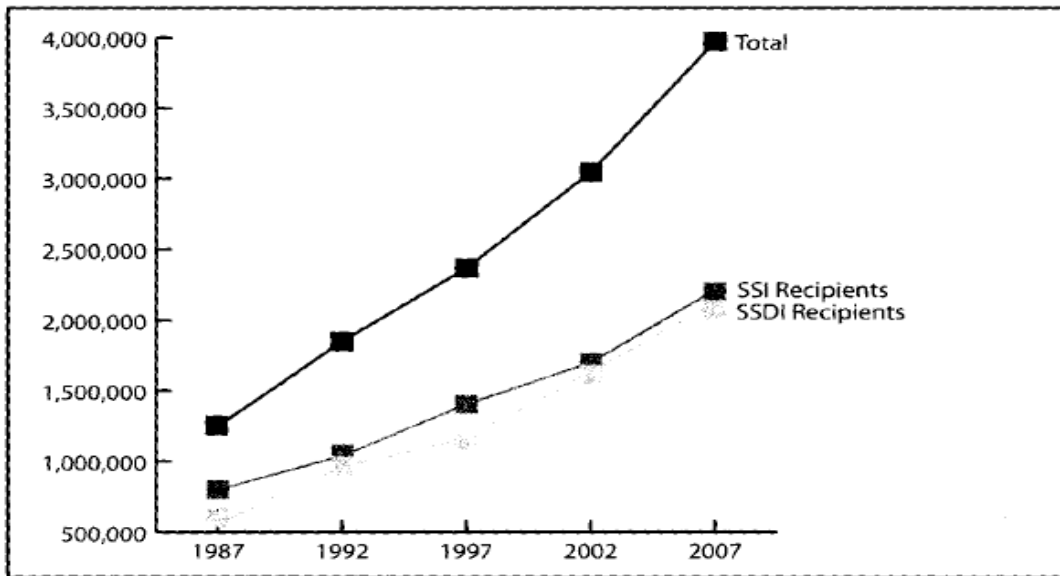
**The Hospitalized Mentally Ill in 1955**

	First Admissions	Resident Patients
<b>Psychotic Disorders</b>		
Schizophrenia	28,482	267,603
Manic-depressive	9,679	50,937
Other	1,387	14,734
<b>Psychoneurosis (Anxiety)</b>	6,549	5,415
<b>Personality Disorders</b>	8,730	9,739
<b>All Others</b>	6,497	6,966

Although there were 558,922 resident patients in state and county mental hospitals in 1955, only 355,000 suffered from mental illness. The other 200,000 were elderly patients suffering from dementia, end-stage syphilis, alcoholism, mental retardation, and various neurological syndromes. Source: Silverman, C. *The Epidemiology of Depression* (1968): 139.

Fig 2: The hospitalized mentally ill in the year 1955 [14]

### The Disabled Mentally Ill in the Prozac Era SSI and SSDI Recipients Under Age 65 Disabled by Mental Illness, 1987–2007

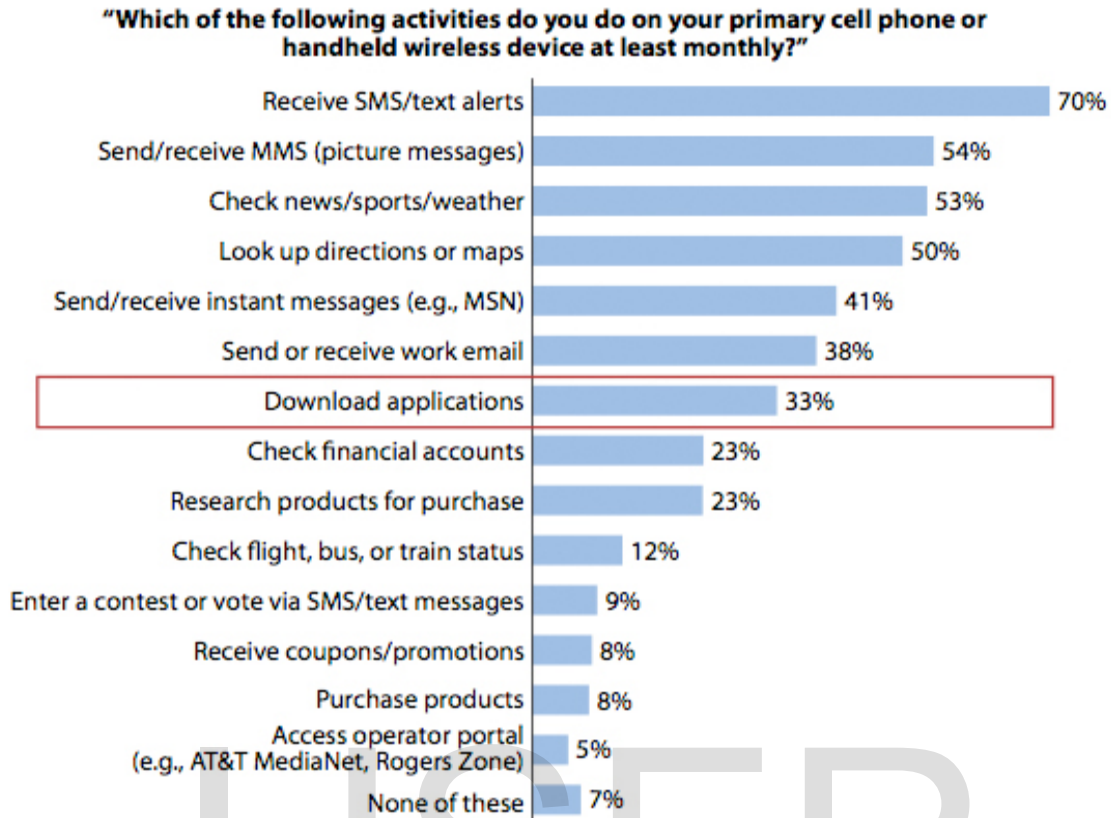


One in every six SSDI recipients also receives an SSI payment; thus the total number of recipients is less than the sum of the SSI and SSDI numbers. Source: Social Security Administration reports, 1987–2007.

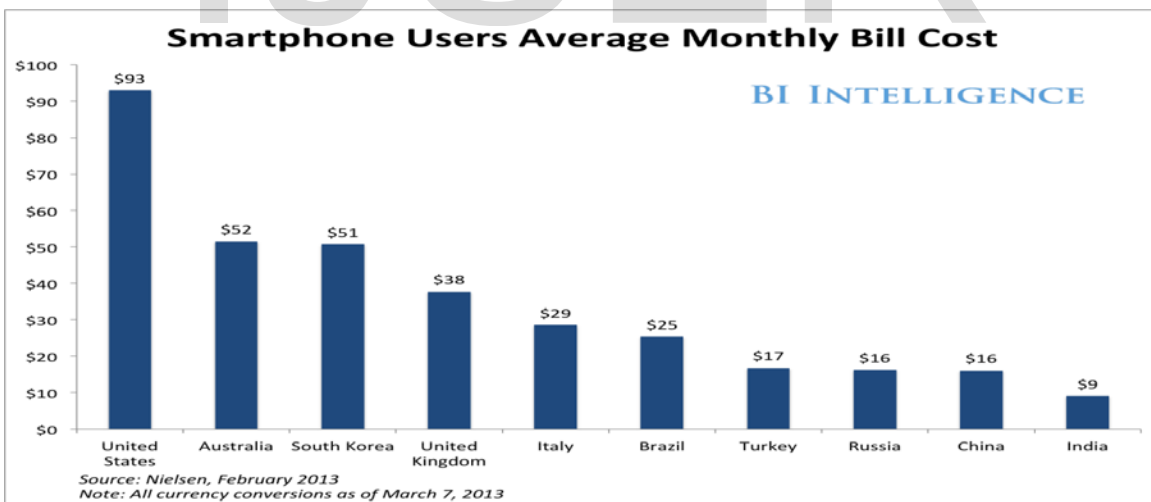
Fig 3, the disability due to mental illness, 1987-2007 [14]



Fig.4, More than 90% of apps are free, and prices keep dropping [20]



**Fig.5, The explosion of app development that started on the iPhone [21]**



**Fig.6, Country wise cost of smart phone [21]**

## **Learned Helplessness (LH) Model**

While there has been so much work and research on the state of helplessness and the remedial measures [2] to overcome the state of helplessness has also been suggested. The consequences of the state of helplessness have also been elaborated in a nice way. Here we would investigate the cure of this mental illness specifically through the emerging technologies in bringing an individual out of the mental stress.

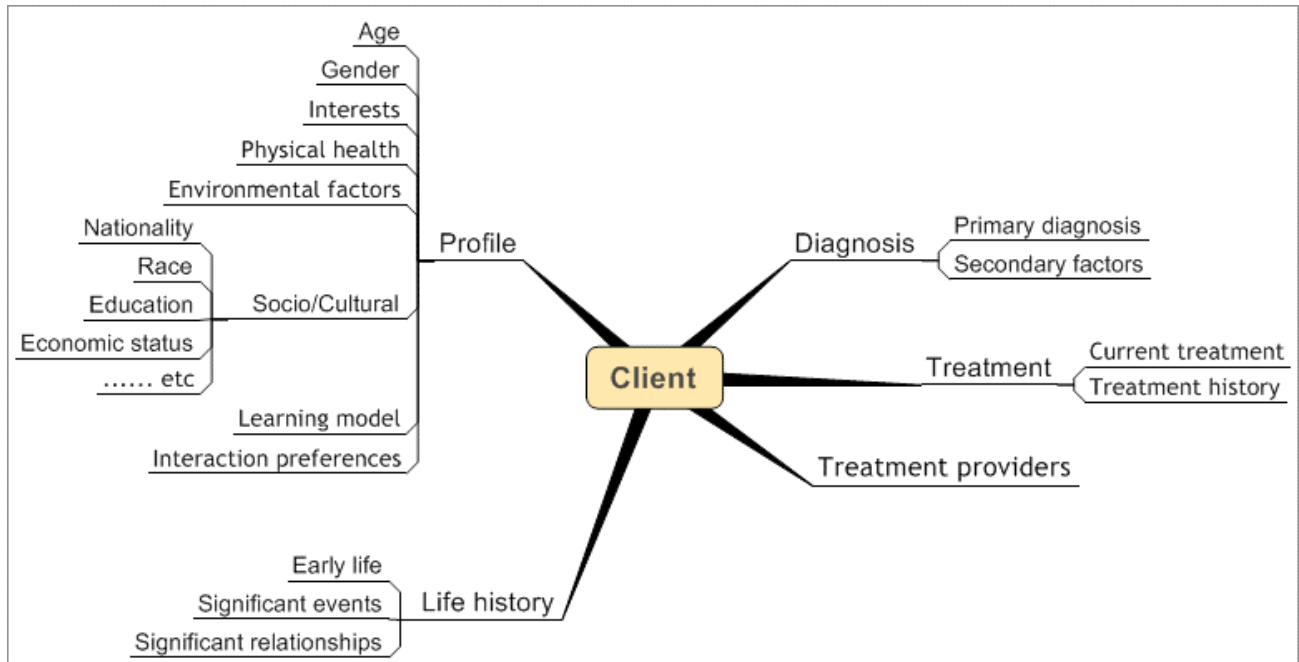
According to the learned helplessness theory, the individual perceives the helplessness based upon his or her earlier experiences of the life. The infant develops this state owing to his or her experiences of powerlessness in the face of his or her daily needs. The inability of child leads him or her to distress. The anxiety of a kid is intricately related to the state of helplessness and the effect of the distress.

Other theory [12] blames the size of human pelvis as responsible for the underdeveloped brain of a typical baby when compared with the brain size of a chimp baby. [12].The LH model has limited usefulness as a scientific and clinical concept. The LH model has some serious drawbacks. The specificity of the subject under consideration is highly compromised by the existing model [8].

## **Application of Emerging Technologies: E-Diagnostics & E-Therapeutics**

The employment of the electronic and communication technologies as a therapeutic aid to healthcare practices may be termed as telemedicine or e-health [10]. With the current pace of the development of the electronic and communication media technologies the mental disorders can be treated in a far better way and we can assist the LH in a much better way. These systems can detect the individuals at the risk of the LH by algorithms that can detect the neurological states of persons. These systems can be available in the forms of the games, aps and the interactive programs that are intelligent enough to be friendly with the individual and trace the early symptoms of the LH. The current LH model may be assisted in taking into account the slight varieties of LH model to support the advancement in the LH model through the date gathered on the individual patients and inferring the specificity of the LH model from the heaps of date. It can help in the improvement of the accessibility, effectiveness and affordability of the current state of the mental health of an individual. The virtual reality VR has been employed and the computer games are been employed to treat mental illness;

- Web-based, mobile and virtual technologies to treat depression and other moods
- Virtual human therapist who will work with teens to prevent depression
- A medicine bottle that reminds you to take antidepressant medication and tells your doctor if the dosage needs adjusting
- A web-based social network to help cancer survivors relieve sadness and stress



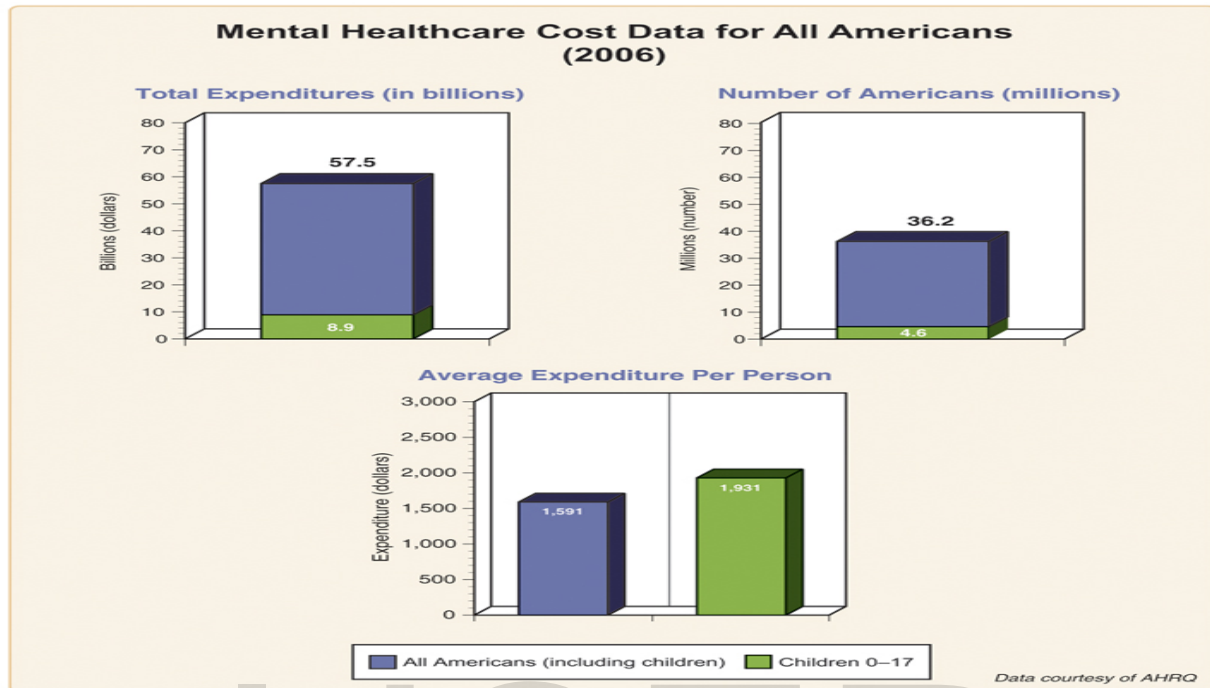
**Fig-7 Client ontology for the MHC domain [11]**

## Expected Outcomes & Precautions Using the Emerging Technologies

Following may be some of the expected outcomes and precautions taken while employing these emerging technologies

- Real-time symptom and activity monitoring
- And tracking of treatment progress
- Personalized feedback and motivation support
- Portability and flexibility of use
- Potential to improve adherence to treatment
- Technical problems
- Issues of data security
- Patient privacy, and the
- Identification and timely management of crisis
- Risk of harm
- Education of users and further development of evidence-based mental health apps is warranted,
- Considering industry regulation
- Large volume of commercial apps
- Smaller number of tested evidence-based apps

## Cost Effective Solution of the Problem

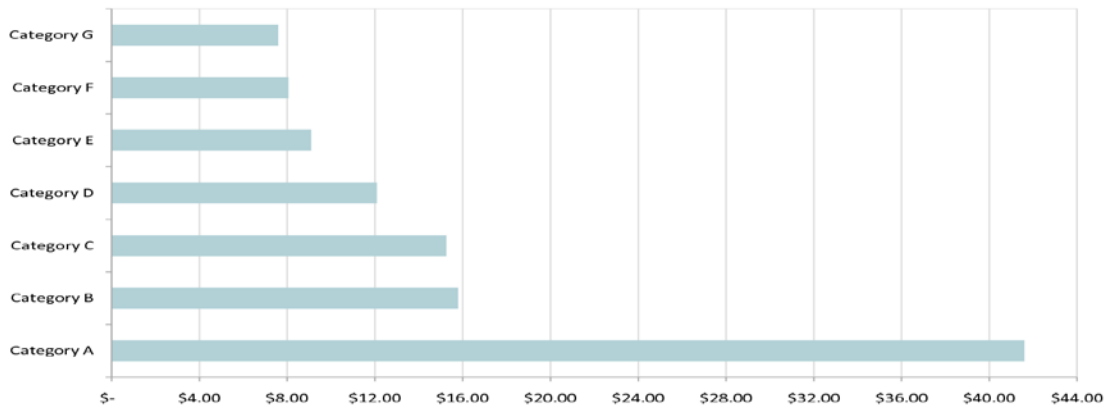


**Fig-8 Mental Healthcare Cost Data for All Americans (2006) [19]**

Fig.8 provides the cost of mental health care for average American. The average expenditure per person was \$1,591 [19]. In contrast, most of the apps are open source and freely available. There are only 10 percent of all apps which are not free. The iPad-optimized titles are the most costly having the average price amounting to \$0.50, followed by iPhone/iPod Touch apps with the average price of \$0.19. With the Android apps the average price is the cheapest, that is, \$0.06. The average price of mHealth app may also be seen in Fig 9

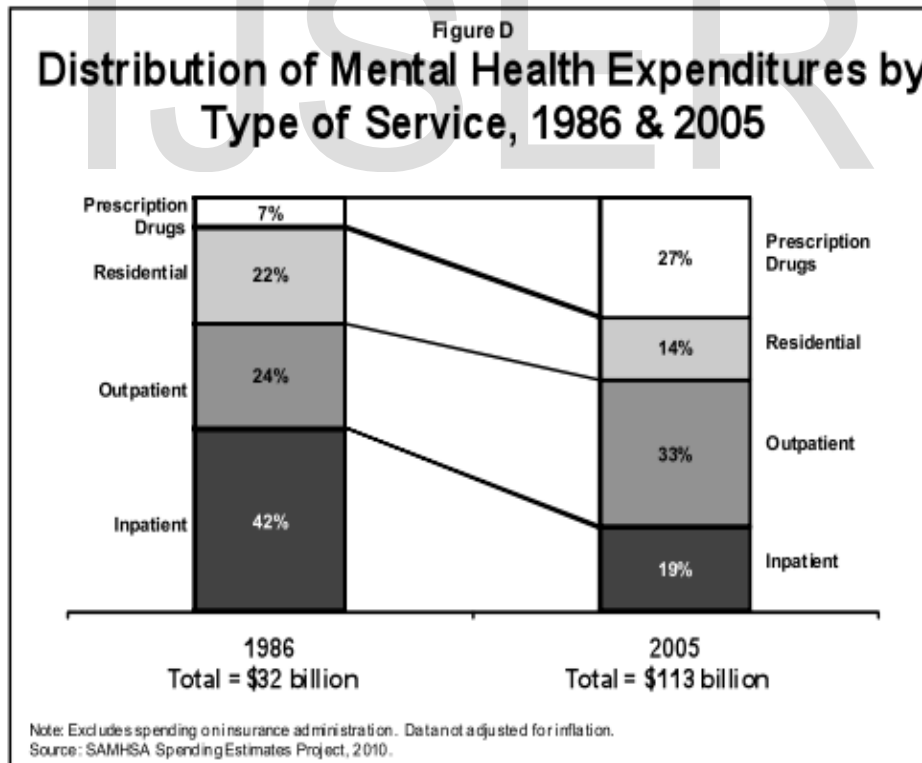
The most interesting aspect comes up when we look at the breakup of the medical expenses of a patient suffering from a mental disorder. The major portion of the expenses is attributed to residential, outpatient or inpatient services while drugs cost the minimum expenses. The residential, outpatient and inpatient services can be sufficiently assisted by the smart phone apps and other emerging technologies saving millions of US dollars.(See figures 4-10)

**Average Price of Paid mHealth Applications per Category (PREVIEW)**



Base: All mHealth applications from Windows Marketplace for Mobile; Top 100 most popular mHealth applications from BlackBerry App World, PocketGear, Handango; Top 200 most popular mHealth applications from Android Market, Apple App Store.  
 Source: research2guidance

**Fig-9 Average Price of Paid health mHealth app [21]**



**Fig 10 Distribution of the medical expenditures [21]**



## Conclusion

The traditional approaches to diagnostics and therapeutics have helped in a very limited way to treat and cure mental disorders. The current understanding of the LH model needs an increased understanding of the depression and necessitates the development of novel, improved antidepressant treatments supported by emerging technologies. This article discusses the weaknesses associated with the learned helplessness model and associates the link between the growing numbers of mentally retarded persons with the deficiencies in the existing models of the mental diseases. The specific reference to the growing number of the mental illness is discussed as well. A drastic cut in the budgets for the mental disorders in USA is later on discussed as a serious issue. The role of emerging technologies is reported by citing some references from literature and examples have been shown how smart phones and apps can be used to cure the metal disorders. A brief survey is shown which shows the increased number of smart phones in USA. The emerging technologies using smart phones, apps and computers could be utilized to cure the mental disorders and reduce the financial burden on US economy.

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